

**Remarks/Arguments**

In response to the Office Action mailed March 14, 2007, Applicants respectfully request that the Examiner reconsider the rejections of the claims in light of the remarks below.

Claims 1-27 are pending in the Application.

Claims 1-27 stand rejected.

**I. Rejections under 35 USC 102/103 Claims 1-4 and 7**

Claims 1-4 and 7 stand rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) Harutyunyan (U.S. Patent No. 7,014,737) Office Action I at page 5. Applicants respectfully traverse these rejections.

*102(e)*

Claim 1 recites a method for crosslinking carbon nanotubes comprising the steps of (1) providing carbon nanotubes and (2) *irradiating said nanotubes* with microwave radiation to crosslink the carbon nanotubes.

The Examiner has stated that Harutyunyan teaches a method of crosslinking carbon nanotubes. Applicant respectfully disagrees and points out that Harutyunyan does not teach crosslinking carbon nanotubes, but rather the purification of carbon nanotubes. Harutyunyan achieves the purification of nanotubes by localized heating of the residual metal particle catalyst (which may be encased in carbon shells) with microwave radiation. For example, see the Abstract, col. 3, lines 22-25, and col. 4, lines 28-33. Indeed, Harutyunyan extols the virtue of using metal catalysts that have different physical properties from the nanotubes to enable localized heating of the encased metal residue. See column 5, line 55-67 through column 6, lines 1-3. Again in column 6, lines 21-25, Harutyunyan states that the purification step "preferably includes a step of selectively inducing localized heating in the impurities,..." Thus, Harutyunyan

discloses selectivity in absorption of the microwave radiation by the metal impurities and not the nanotubes.

An anticipation rejection of a claim under 35 U.S.C. §102(e) requires identity of invention; each and every feature of the claim must be identified by the Examiner, either explicitly or inherently, in a single prior art reference. Further, to establish inherency, extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the device or system described in the reference, and that it would be so recognized by persons of ordinary skill in the art. *In re Robertson*, 169 F.3d 743, 49 USPQ2d 1949 (Fed. Cir. 1999). Inherency may not be established by probabilities or possibilities; the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. *Scaltech, Inc. v. Retech/Tetra L.L.C.*, 156 F.3d 1193, 51 USPQ.2d 1055 (Fed. Cir. 1999). The Examiner has not met this burden as to the claims of the present application and thus, Claim 1 is patentable over Harutyunyan. Claims 2-4 and 7 depend either directly or indirectly from claim 1 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

*103(a)*

Before a claim may be rejected under section 103, the examiner must establish a *prima facie* case of obviousness. See MANUAL OF PATENT EXAMINING PROCEDURE § 2142. A *prima facie* case consists of three elements. "There must be some suggestion or motivation . . . to modify the reference or combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

In response to the Examiner's obviousness rejection of Claim 1, Harutyunyan's teachings are directed to the purification of carbon nanotubes. Modification of the Harutyunyan's procedure to crosslink carbon nanotubes would teach away from this very purpose. The Examiner is reminded that a proposed modification cannot change the principle of operation of the prior art being modified, nor can the proposed modification render the prior art unsatisfactory

for its intended purpose. *See* M.P.E.P. 2143.01, *see also In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959) and *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984), respectively.

Furthermore, Harutyunyan fails to teach all the elements of the present invention. For these reasons, the Examiner has not established a *prima facie* case of obviousness.

Accordingly, Claim 1 is not obvious and is patentable over Harutyunyan. Claims 2-4 and 7 depend from claim 1 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Finally, Applicant traverses the statement made by the Examiner that the Applicant is only defining the subject matter in terms of the results to be achieved...without providing the technical features necessary for achieving the result. The desired result is crosslinked carbon nanotubes. This is achieved by 1) starting with carbon nanotubes and 2) irradiating them with microwaves as stated clearly in claim 1. Irradiation of carbon nanotubes with microwaves is the technical feature that solves the problem of how to crosslink the carbon nanotubes.

## **II. Rejections under 35 USC 102/103 Claims 8-9, 11-15, and 18**

Claims 8-9, 11-15 and 18 stand rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) Harutyunyan (U.S. Patent No. 7,014,737) Office Action II at page 7. Applicants respectfully traverse these rejections.

### *102(e)*

Claim 8 is patentable for at least the same reasons stated above in section I, for Claim 1. Thus, Claim 8 is patentable over Harutyunyan. Claims 11-12 and 14-18 depend from Claim 8 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

### *103(a)*

Claim 8 is also not obvious for reasons stated above for claim 1. Again, Harutyunyan teaches away from crosslinking carbon nanotubes by having the objective of purifying carbon nanotubes. Thus, Claim 8 is patentable over Harutyunyan. Claims 11-12 and 14-18 depend from Claim 8 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Applicant also reiterates traversal of the statement by the Examiner that the Applicant has stated the problem without providing the technical feature to solve the problem.

### **III. Rejections under 35 USC 102/103 Claims 19, 21-24 and 27**

Claims 19, 21-24, and 27 stand rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) Harutyunyan (U.S. Patent No. 7,014,737) Office Action III at page 9. Applicants respectfully traverse these rejections.

#### *102(e)*

Claim 19 is patentable for at least the same reasons stated above for Claim 1. Thus, Claim 19 is patentable over Harutyunyan. Claims 21-24 and 27 depend from Claim 19 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

#### *103(a)*

Claim 19 is also not obvious for reasons stated above in section I, for claim 1. Thus, claim 19 is patentable over Harutyunyan. Claims 21-24 and 27 depend from claim 19 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Applicant also reiterates traversal of the statement by the Examiner that the Applicant has stated the problem without providing the technical feature to solve the problem.

#### **IV. Rejections under 35 USC 102/103 Claims 1 and 7**

Claims 1 and 7 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over WO 01/75903 ('903). Office Action IV at page 11. Applicants respectfully traverse these rejections.

##### *102(b)*

Claim 1 recites a method for crosslinking carbon nanotubes comprising the steps of (1) providing carbon nanotubes and (2) irradiating said nanotubes with microwave radiation to crosslink the carbon nanotubes.

The Examiner has stated that the '903 publication teaches a method of crosslinking carbon nanotubes (CNTs). Applicant respectfully disagrees and points out that '903 publication does not teach crosslinking CNTs, but rather teaches conducting materials containing both nanostructures (including CNTs) AND a charge-transfer agent that is able to transfer charge between itself and the nanostructure. Furthermore, the charge transfer agent is adapted to shift the Fermi level of the nanostructure to attain enhanced conductivity. See claim 1 of the '903 patent, for example. Thus, the '903 patent is not providing carbon nanotubes as disclosed in claim 1 of the present invention. That is, the '903 patent provides a modified carbon nanotube with a charge transfer agent as part of a conducting material, thus changing the properties of the carbon nanotubes, including the CNTs behavior when subjected to microwave radiation. Thus, although the '903 publication teaches irradiating with microwaves, the CNTs have been modified to behave as conductors and no crosslinking is observed.

An anticipation rejection of a claim under 35 U.S.C. §102(e) requires identity of invention; each and every feature of the claim must be identified by the Examiner, either explicitly or inherently, in a single prior art reference. Further, to establish inherency, extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the device

or system described in the reference, and that it would be so recognized by persons of ordinary skill in the art. *In re Robertson*, 169 F.3d 743, 49 USPQ2d 1949 (Fed. Cir. 1999). Inherency may not be established by probabilities or possibilities; the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. *Scaltech, Inc. v. Retech/Tetra L.L.C.*, 156 F.3d 1193, 51 USPQ.2d 1055 (Fed. Cir. 1999). The Examiner has not met this burden as to the claims of the present application and thus, Claim 1 is patentable over the '903 publication. Claim 7 depends directly from claim 1 and is therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

103(a)

Before a claim may be rejected under section 103, the examiner must establish a *prima facie* case of obviousness. See MANUAL OF PATENT EXAMINING PROCEDURE § 2142. A *prima facie* case consists of three elements. "There must be some suggestion or motivation . . . to modify the reference or combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

In response to the Examiner's obviousness rejection of Claim 1, the '903 publication teaches enhancing the conductivity of carbon nanotubes. Modification of the '903 publication to crosslink carbon nanotubes would teach away from this very purpose, since it would require the removal of the charge transfer agent, the very element required to alter the conductive properties of the CNTs. The Examiner is reminded that a proposed modification cannot change the principle of operation of the prior art being modified, nor can the proposed modification render the prior art unsatisfactory for its intended purpose. See M.P.E.P. 2143.01, *see also In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959) and *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984), respectively.

Furthermore, the '903 publication fails to teach all the elements of the present invention. For these reasons, the Examiner has not established a *prima facie* case of obviousness.

Accordingly, claim 1 is not obvious and is patentable over the '903 publication. Claim 7 depends from claim 1 and is therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Once again, Applicant traverses the statement made by the Examiner that the Applicant is only defining the subject matter in terms of the results to be achieved...without providing the technical features necessary for achieving the result. The desired result is crosslinked carbon nanotubes. This is achieved by 1) starting with carbon nanotubes and 2) irradiating them with microwaves as stated clearly in claim 1. Irradiation of carbon nanotubes with microwaves is the technical feature that solves the problem of how to crosslink the carbon nanotubes.

#### **V. Rejections under 35 USC 102/103 Claims 8-9, 11-12, and 18**

Claims 8-9, 11-12 and 18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over WO 01/75903 ('903). Office Action V at page 12. Applicants respectfully traverse these rejections.

##### *102(b)*

Claim 8 is patentable for at least the same reasons stated above in section IV, for Claim 1. Thus, claim 8 is patentable over the '903 publication. Claims 9, 11-12 and 18 depend from claim 8 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

##### *103(a)*

Claim 8 is also not obvious for reasons stated above in section IV, for claim 1. Thus, claim 8 is patentable over the '903 publication. Claims 9, 11-12 and 18 depend from claim 8 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Applicant also reiterates traversal of the statement by the Examiner that the Applicant has stated the problem without providing the technical feature to solve the problem.

## **VI. Rejections under 35 USC 102/103 Claims 1 and 7**

Claims 1 and 7 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over KR 2002-0046342 (KR '342). Office Action VI at page 13. Applicants respectfully traverse these rejections.

### *102(b)*

Claim 1 recites a method for crosslinking carbon nanotubes comprising the steps of (1) providing carbon nanotubes and (2) irradiating said nanotubes with microwave radiation to crosslink the carbon nanotubes.

The Examiner has stated that KR '342 teaches a method of crosslinking carbon nanotubes (CNTs). Applicant respectfully disagrees and points out that KR '342 does not teach crosslinking CNTs, but rather teaches using a helical carbon nanotube to provide local heating to cancerous tissue. Not only is this unrelated art, but to even entertain the possibility of crosslinking, more than one CNT must be provided. Thus, KR '342 is not providing carbon nanotubes as disclosed in claim 1 of the present invention. That is, KR '342 provides a single helical carbon nanotube implanted within a tissue (or delivered via nano-size capsule, page 6 paragraph 4) for creating local heating. Thus, although KR '342 teaches irradiating with microwaves, a single helical CNT can't crosslink when other CNTs are not provided and thus, no crosslinking is observed.

An anticipation rejection of a claim under 35 U.S.C. §102(b) requires identity of invention; each and every feature of the claim must be identified by the Examiner, either explicitly or inherently, in a single prior art reference. Further, to establish inherency, extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the device or system described in the reference, and that it would be so recognized by persons of ordinary skill in the art. *In re Robertson*, 169 F.3d 743, 49 USPQ2d 1949 (Fed. Cir. 1999). Inherency



may not be established by probabilities or possibilities; the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. *Scaltech, Inc. v. Retech/Tetra L.L.C.*, 156 F.3d 1193, 51 USPQ.2d 1055 (Fed. Cir. 1999). The Examiner has not met this burden as to the claims of the present application and thus, Claim 1 is patentable over KR '342. Claim 7 depends directly from claim 1 and is therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

103(a)

Before a claim may be rejected under section 103, the examiner must establish a *prima facie* case of obviousness. See MANUAL OF PATENT EXAMINING PROCEDURE § 2142. A *prima facie* case consists of three elements. "There must be some suggestion or motivation . . . to modify the reference or combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

In response to the Examiner's obviousness rejection of Claim 1, KR '342 teaches local heating in cancerous tissues using irradiation of a helical carbon nanotube delivered to the tissue. Modification of KR '342 to crosslink carbon nanotubes would first require providing multiple nanotubes and assuring that these tubes were in proximity to each other for effective crosslinking. Such crosslinking teaches away from the intended purpose, since it would alter the ability of the CNTs to provide heat by altering the absorption properties of the CNTs. Furthermore, to optimize crosslinking of the CNTs to each other, one would not want the CNTs to be in the vicinity of reactive material such as the cancerous tissue. The Examiner is reminded that a proposed modification cannot change the principle of operation of the prior art being modified, nor can the proposed modification render the prior art unsatisfactory for its intended purpose. See M.P.E.P. 2143.01, *see also In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959) and *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984), respectively.

Furthermore, KR '342 fails to teach all the elements of the present invention. For these reasons, the Examiner has not established a *prima facie* case of obviousness.

Accordingly, claim 1 is not obvious and is patentable over KR '342. Claim 7 depends from claim 1 and is therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Applicant also reiterates traversal of the statement by the Examiner that the Applicant has stated the problem without providing the technical feature to solve the problem.

**VII. Rejections under 35 USC 102/103 Claims 8, 11-12, and 18**

Claims 8, 11-12 and 18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over KR 2002-0046342 (KR '342). Office Action VII at page 14. Applicants respectfully traverse these rejections.

*102(b)*

Claim 8 is patentable for at least the same reasons stated above in section VI, for Claim 1. Thus, claim 8 is patentable over KR '342. Claims 11-12 and 18 depend from claim 8 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

*103(a)*

Claim 8 is also not obvious for reasons stated above in section VI, for claim 1. Claims 9, 11-12 and 18 depend from claim 8 and are therefore patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

Applicant also reiterates traversal of the statement by the Examiner that the Applicant has stated the problem without providing the technical feature to solve the problem.

**VIII. Rejections under 35 USC 103 Claims 5 and 6**

Claims 5 and 6 stand rejected under 35 U.S.C. § 103 (a) as being obvious over Harutyunyan (U.S. Patent No. 7,014,737) in view of Fliflet ("Application of Microwave Heating to Ceramic Processing: Design and Initial Operation of a 2.45-GHz Single-Mode Furnace," IEEE Transactions on Plasma Science, Vol. 24, No. 3.) Office Action I at page 16. Applicants respectfully traverse these rejections.

As detailed above in section I, claim 1 is patentable over Harutyunyan. Fliflet does not contribute any substantive matter concerning the patentability of claim 1. Claims 5 and 6 depend either directly or indirectly from claim 1 and are patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

#### **IX. Rejections under 35 USC 103 Claim 10**

Claim 10 stands rejected under 35 U.S.C. § 103 (a) as being obvious over Harutyunyan (U.S. Patent No. 7,014,737) in view of Holtzinger ("Sidewall Functionalization of Carbon Nanotubes," Angew. Chem. Int. Ed., 2001, Vol. 40, No. 21, pp. 4002-4005.) Office Action II at page 17. Applicants respectfully traverse these rejections.

As detailed above in section II, claim 8 is patentable over Harutyunyan. Holtzinger does not contribute any substantive matter concerning the patentability of claim 8. Claim 10 depends from claim 8 and is patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

#### **X. Rejections under 35 USC 103 Claim 16 and 17**

Claims 16 and 17 stand rejected under 35 U.S.C. § 103 (a) as being obvious over Harutyunyan (U.S. Patent No. 7,014,737) in view of Fliflet ("Application of Microwave Heating to Ceramic Processing: Design and Initial Operation of a 2.45-GHz Single-Mode Furnace," IEEE Transactions on Plasma Science, Vol. 24, No. 3.) Office Action III at page 18. Applicants respectfully traverse these rejections.

As detailed above in section II, claim 8 is patentable over Harutyunyan. Fliflet does not contribute any substantive matter concerning the patentability of claim 8. Claims 16 and 17

depend either directly or indirectly from claim 8 and are patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

**XI. Rejections under 35 USC 103 Claim 20**

Claim 20 stands rejected under 35 U.S.C. § 103 (a) as being obvious over Harutyunyan (U.S. Patent No. 7,014,737) in view of Holtzinger ("Sidewall Functionalization of Carbon Nanotubes," *Angew. Chem. Int. Ed.*, 2001, Vol. 40, No. 21, pp. 4002-4005.) Office Action IV at page 19. Applicants respectfully traverse these rejections.

As detailed above in section III, claim 19 is patentable over Harutyunyan. Holtzinger does not contribute any substantive matter concerning the patentability of claim 19. Claim 20 depends from claim 19 and is patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

**XII. Rejections under 35 USC 103 Claim 25 and 26**

Claims 25 and 26 stand rejected under 35 U.S.C. § 103 (a) as being obvious over Harutyunyan (U.S. Patent No. 7,014,737) in view of Fliflet ("Application of Microwave Heating to Ceramic Processing: Design and Initial Operation of a 2.45-GHz Single-Mode Furnace," *IEEE Transactions on Plasma Science*, Vol. 24, No. 3.) Office Action V at page 20. Applicants respectfully traverse these rejections.

As detailed above in section III, claim 19 is patentable over Harutyunyan. Fliflet does not contribute any substantive matter concerning the patentability of claim 9. Claims 25 and 26 depend either directly or indirectly from claim 19 and are patentable for at least the same reasons. Thus, withdrawal of this rejection is respectfully requested.

If the Examiner has any questions or comments concerning this paper or the present application in general, the Examiner is invited to call the undersigned at (713) 650-2764.

Dated:

Respectfully submitted,

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